

Anabolic Steroids Improve Bone Mineral Density and Quality of Life in Patients with Osteoporotic Fractures Around the Hip

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Katz index of independence in activities of daily living showed marked improvement. The patients of group 2 showed less marked improvement in their mean t-scores as well as the mean Harris hip score and the Katz index.

CONCLUSION: The current study suggests that the use of low dose anabolic steroids results in a significant gain in bone mass and improvement in quality of life in geriatric population, but comparative studies with a larger sample size and longer follow up are required to further support this observation.

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Key words: Anabolic steroids; Osteoporosis; Hip fracture

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ABSTRACT

AIM: Osteoporotic fractures cause considerable morbidity and disability in both women and men. The current prospective study was designed to identify the effect of anabolic steroids in patients with osteoporotic fractures around the hip.

METHODS: A total of 248 patients with unilateral osteoporotic hip fractures ($t \leq -2.5$, as measured by a DEXA of the contra-lateral hip) were included in the study and divided into two groups randomly. Group 1 comprising of 132 patients, was given Nandrolone 50 milligrams once a week for 5 weeks, along with 500 mg of elemental calcium and 0.25 micrograms of calcitriol once daily for 3 months, starting from the next day of surgery. Group 2 comprising of 116 patients was given only 500 mg of elemental calcium and 0.25 micrograms of calcitriol once daily for 3 months from the first post operative day. In group 1 eight patients expired and 24 were lost to follow up, leaving a total of 100 patients at the final follow up of 1 year; while in group 2 ten expired and 20 were lost to follow up leaving a total of 86 at final follow up. The patients were evaluated at 3, 6 and 12 months for BMD, Katz index for activities of daily living and functional improvement.

RESULTS: In Group 1 it was observed that the mean t-score improved from -2.916 ± 0.573 at presentation to -2.112 ± 0.599 at 12 months. The mean Harris Hip Score was 85.44 ± 10.56 and the

INTRODUCTION

WHO has defined osteoporosis as a bone mineral density that is 2.5 standard deviations or more below the mean peak bone mass (average of young, healthy adults) as measured by dual-energy X-ray absorptiometry^[1]. It is a condition characterized by reduced bone density predisposing to fractures following trivial trauma. Unlike previously when it was considered to be a condition largely affecting females, today with prolonged life expectancy men are also at a significant risk^[2,3]. The morbidity following an osteoporotic hip fracture alone is quite noteworthy with only about 21% living independently following such an incident^[3]. The mortality also is drastically high at 20%^[4]. The process of losing bone density begins early in life and continues into old age^[5]. The process is further hastened by secondary conditions seen in almost 50% of the patients^[6]. Until the recent advent of dual energy X-ray absorptiometry, the diagnosis of osteoporosis was based on clinical

and X-ray features and was graded as per the Singh's Index^[7]. With the advent of DEXA, bone mineral density measurement has gold standard of diagnosing osteoporosis. Studies have shown a direct relationship between bone mineral density and risk of fracture^[8]. Various treatment modalities have been advocated to control this major public health concern; the mechanism of their action being either by stimulating bone formation or by suppressing bone resorption. Anabolic steroids have been found to have a dual mode of action. They act by both, preventing bone re-sorption by impeding the osteoclastic activity and stimulating bone formation through androgen receptors in bone^[9]. Hedström M *et al* in a randomized controlled trial on 63 women have shown significant improvement in the DEXA scores and Harris Hip Scores in patients treated with anabolic steroids^[10]. Anabolic steroids also stimulate functional recovery by counter-balancing the catabolic state following fracture and it's healing process^[10]. Reviewing the literature we realized that this aspect in the management of osteoporosis has been very little worked upon in recent times. Hence, we decided to undertake this prospective study to evaluate the effect of anabolic steroids on patients with osteoporotic fractures of the hip.

METHOD

In a prospective study of 248 consecutive patients aging more than 60 years, ($t \leq -2.5$, as measured by dual energy X-ray absorptiometry of the contra-lateral hip) presenting with unilateral fractures of the hip following trivial trauma to our tertiary care center, we studied the effect of anabolic steroid on the bone mineral density and the patient's functional recovery. The patients were randomly divided into two groups. Group one was treated with Nandrolone 50 milligrams once a week for five weeks, along with 500 milligrams of elemental calcium and 0.25 micrograms of calcitriol once daily for 3 months, starting from the day after the surgery; while group two was administered only 500 milligrams of elemental calcium and 0.25 micrograms of calcitriol once daily for 3 months from the day of surgery. Eight patients of the 132 patients in group one expired and 24 were lost to follow up leaving a total of 100 patients who were evaluated at the time of final follow up of 1 year. Thirty-eight of these had associated co-morbidities; the treatment regimen however was not altered for the associated co-morbidities. Each patient was given a course of Nandrolone 50 milligrams, given deep intramuscular every week for five weeks, starting a day after the surgery, irrespective of the modality of treatment of the fracture. Every patient included in the study was treated with a suitable operation after getting the patient fit for anesthesia. Post-operatively each patient was mobilized on the second post-operative day and advised a similar physiotherapy and diet plan. Each patient was also given a course of elemental calcium 500 milligram and calcitriol 0.25 micrograms once daily for 3 months. The patients were followed up at 3 months, 6 months and 12 months. They were screened for any possible steroid related side effects together with measurement of bone mineral density, calculation of Katz index for activities of daily living and measurement of functional improvement in the operated hip as per the Harris Hip Score.

In the second group, of the total 116 patients ten expired and twenty were lost to follow up leaving a total of 86 at final follow up, of which 18 had associated co-morbidities which however did not alter the treatment regimen. Each patient was given a course of elemental calcium 500 milligram and calcitriol 0.25 micrograms once daily for 3 months and similarly evaluated at 3 months, 6 months and 12 months.

RESULT

Analyzing the data hence compiled showed an almost equal age distribution of patients with about one third patients in their 7th, 8th and 9th decade of life each in both the groups. At the end of our study we had 47 males and 53 females with 68 inter-trochanteric fractures and 32 fractures of the neck of femur in group one. The co-morbidities included diabetes ($n=12$) and hypertension ($n=26$). The associated co-morbidities however did not show any significant effect on the final outcome of the patients.

In the second group we had 40 males and 46 females at final follow up with 60 inter-trochanteric fractures and 26 fractures of neck of femur. 10 patients were diabetic while 18 were hypertensive. Two were diabetic along with hypertensive.

We did not observe any significant variations in results between the two sexes. The improvement in the bone mineral density was comparable irrespective of the type of surgery the patient underwent. The bone mineral density t- scores of the patients were measured using dual energy X-ray absorptiometry at presentation and later at 3, 6 and 12 months of follow up and analyzed. It was observed that the mean t-score improved from -2.916 ± 0.573 at presentation to -2.112 ± 0.599 at 12 months which was statistically significant (p value < 0.0001) (Figure 1). The z-scores obtained using the dual energy X-ray absorptiometry showed improvement from the mean -1.808 ± 0.677 to a mean of -1.067 ± 0.652 at final follow up this difference too was statistically significant (p value < 0.0001) (Figure 2).

At final follow up of 12 months the mean Harris Hip Score was (85.44 ± 10.56) (Figure 3). The Katz index of independence in activities of daily living too showed improvement on follow up (Figure 4). Majority of the patients were completely independent in their activities of daily living at final follow up. This could be attributed to the generalized well-being due to the treatment regimen give. As far

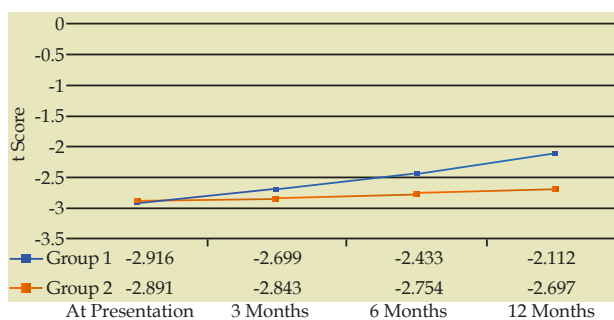


Figure 1 Mean t-score shows comparatively more improvement at successive follow ups of group 1 compared to that of group 2.

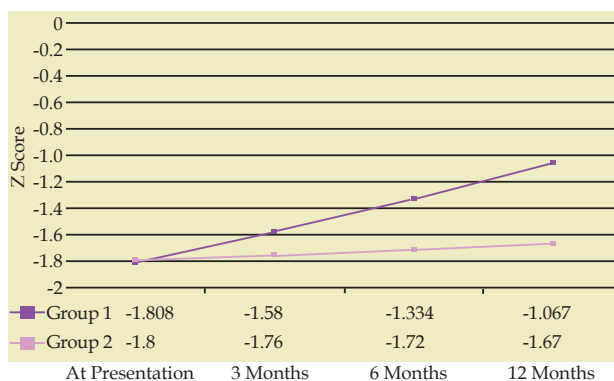


Figure 2 Mean z - score shows comparatively better improvement at successive follow ups of group 1 compared to that of group 2.

as side effects are concerned, we did not notice any steroid related side effects in any of our patients; this could partly be attributed to the fact that the steroids so administered were given in low doses.

The group treated with just vitamin D and calcium showed improvements in their t- score to a lesser extent. The mean t-score improved from -2.891 at presentation to -2.697±0.7 at 12 months follow up. The z-scores obtained using the dual energy X-ray absorptiometry showed improvement from the mean 1.877±0.66 to a mean of -1.667±0.55, at final follow up. The improvement shown in this group was statistically insignificant with a *p* value of 0.09. At 12 months follow up the mean Harris Hip Score was 80.78±9.45. Following up the Katz index of independence in activities of daily living showed that the improvement was significantly less compared to the group on nandrolone decanoate.

Comparing the results obtained at the end of 12 months, it was obvious that the improvement in the BMD as well as the functional improvement in the group on anabolic steroids was significantly more than the group not put on anabolic steroids.

The patients put on anabolic steroids showed better improvements in their Harris Hip Scores and Katz index compared to patients who did not receive anabolic steroids. The difference in the mean Harris Hip Score between the two groups was statistically significant with a *p* value of 0.0019.

found to be more prone to osteoporosis thus making its appropriate management more noteworthy in our scenario^[11]. Since their first development in the 1950's anabolic steroids have been widely used in the management of osteoporosis, although their efficacy and mechanism of action are only recently established, the fact that it leads to considerable improvement in bone mass has been well established now^[12].

With the goal of preventing further fractures and returning the patients back to their social life early, anabolic steroids have been advocated as the ideal treatment for osteoporosis. They act by increasing the bone mass at the fracture site and counter-balancing the catabolic state of the body, thus bringing about a state of well being. In addition, they also help increase the lean muscle mass^[13].

Villareal *et al*^[14] had described a treatment regime with dihydroepiandrosterone in elderly patients. They observed an increase in the bone mineral density and a reversal of age related changes with increase in the lean body mass and a decrease in the fat mass.

In a prospective study of 63 women by Hedström M *et al* it was evident that the patients on anabolic steroids did not lose muscle volume during the first 12 months whereas the control group did (*p*<0.01). Their bone loss was also less compared to the control group. The patient group treated with anabolic steroids showed significant improvements in their bone mineral density and Harris Hip Scores compared to the patients not treated with anabolic steroids^[10].

The addition of calcitriol and calcium is known to provide additional protective effect against fractures by the virtue of their action on muscle mass; thus, also decreasing the incidence of falls^[15]. Inkovaara J *et al* in their double-blind placebo-controlled long-term clinical trial concluded that methandienone (anabolic steroid) reduces osteoporosis best when used along with calcium and Vitamin D. Thinking on the same lines we administered calcium and Vitamin D to all our patients^[16].

Need *et al*^[17] had established an increase in bone mineral density in the forearm when giving 50 mg of nandrolone decanoate every third week for one year, as opposed to a decrease in the control group. They also reported a high incidence of hoarseness of voice in the patients treated with anabolic steroids. Other important side effects that have been reported following a course of anabolic steroids are coronary deaths^[16] and deranged liver function^[18]. We however did not face any treatment related side effects in our patients, but we admit that a total of 8 patients expired during the study period of one year following the surgery, and the exact cause of their death could not be identified and coronary deaths cannot be ruled out. But, going by the current figures of our country, the mortality rates are comparable to those of age matched geriatric population in the country and lower than that reported by other studies^[19].

The analysis of data in our study suggests that the treatment with a low dose of anabolic steroids (nandrolone decanoate) in combination with a low dose of calcitriol and calcium results in a significant gain in the bone mass which was made evident by the improvement in the bone mineral density at successive follow ups. Also such doses are not associated with any significant side effects. The same period of follow up also revealed significant improvement in the quality of life of our patients. However, we suggest that comparative studies with a larger sample size are required to further support this observation.

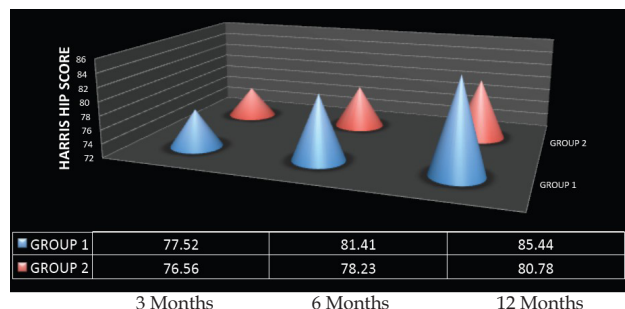


Figure 3 Mean Harris Hip Score shows more improvement at successive follow ups of group one compared to that of group 2.

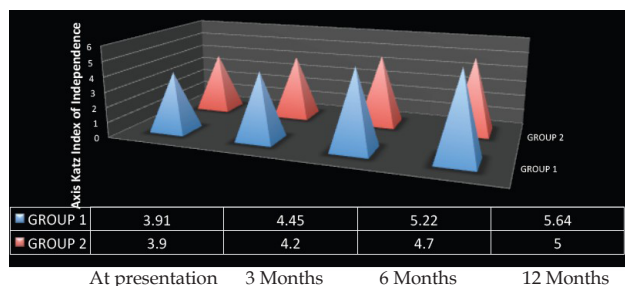


Figure 4 Mean Katz Index of Independence in activities of daily living showing better improvement at successive follow ups of group 1 against that of group 2.

DISCUSSION

Osteoporosis makes bones so feeble that even a mild stress can also lead to a fracture. The hip and the spine are the most common regions affected by osteoporosis. People of Asian origin have been

CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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